

Teaching Skills for Accessing and Interpreting Information from Systematic Reviews/Meta-analyses, Practice Guidelines, and the Internet

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Skills and practice related to accessing and interpreting clinical information from systematic reviews/meta-analyses, practice guidelines, and the Internet have been integrated into a new senior year elective designed to teach medical students how to critically appraise information from a variety of sources and evaluate its applicability to patient care. Small groups of senior medical students under the direction of a multidisciplinary team (behavioral scientist, information specialist, physician) facilitate discussions of clinical articles using checklists designed to evaluate their quality. The central feature of the course is a demonstration of the Cochrane Database of Systematic Reviews (CDSR), an electronic journal distributed by BMJ Publishing, and the requirement that students conduct a literature review on a topic of their choice and present an oral and written summary in the form of a "draft" meta-analysis. Students are provided with strategies to "surf" the Internet/WWW for information, e.g., practice guidelines/treatment protocols, descriptions of on-going clinical trials. A total of 52 students have participated to date. Students have selected project topics across a wide range of medical disciplines, including internal medicine, family practice, OB/GYN, pediatrics, surgery, neurology, emergency medicine, and psychiatry. The course is one of the most favorably evaluated of all senior electives and rated more favorably than the overall mean ratings for all electives combined on 8 of 9 scales, including "Quality of course overall" (4.39 vs. 3.92 on 5-point scale).

INTRODUCTION

The potential of new electronic information resources is increasing almost daily. With the expansion of health and medical resources on the Internet and World Wide Web (WWW), it is becoming increasingly possible to use these resources in real-time in the care of patients (5-7, 14, 19). Moreover, the transition from a paucity of resources to being overwhelmed by information and misinformation is also occurring at a similarly fast pace. Thus there is need to providing training in not only what new

electronic resources are available, but how to sort through increasingly amounts of information and critically appraise its worth and applicability to patient care. In an effort to develop such a training program, a new, senior year elective was designed to teach medical students how to critically appraise and evaluate the medical literature, with attention to its application to patient care (20). The aims of the course are to review the basic research study designs in the context of critically appraising selected articles published in the medical literature using structured protocols. This content is typically introduced either in the pre-clinical years, arguably too early for its relevance and need to be appreciated by students, or in postgraduate years, often too late in the educational continuum after patterns of information seeking are fixed (8-9). Typically, this content is relegated to a small portion of a larger course, rather than designed as a free standing clinical course which is the entire focus of students attention for a specific period of time, as in the present instance.

METHODS

Description of Senior Elective Course

Five years ago all senior medical students at the University of Michigan were required for the first time to select one of a number of newly offered Science in the Clinics electives. Each elective spans an entire four week period in which students have no other required responsibilities. One of these newly designed electives is entitled "Critical Appraisal of the Medical Literature and Application to Patient Care." The major portion of the initial offerings of this course was comprised of small group, 1-1/2 hour seminars which were held twice weekly. These seminars focused on advanced information seeking and critical literature appraisal skills for articles on: therapy, diagnostic tests, literature reviews, clinical measurement, prognosis, quality of care, causation/etiology, harm, guidelines, economic evaluation, clinical measurement, and decision analysis (4, 11-13, 15-18). Several articles from the literature were critically reviewed in which students learn strategies for critically appraising the literature. Students were asked to select the topic(s) of their

choice to be responsible for leading discussion during the seminars. Students learned advanced literature searching skills, including how to "surf" the Internet for relevant medical information. Examples of the

World Wide Web home page URL addresses for some of the more relevant sites that are accessed are summarized in Table 1.

Table 1. Examples of World Wide Web home pages accessed by senior medical students.

AHCPR. Agency for Health Care Policy & Research Home Page [Resource on the World Wide Web]. URL: http://www.ahcpr.gov . Available from: The Internet. Accessed 1997 March 19.
CDC. Center for Disease Control Home Page [Resource on the World Wide Web]. URL: http://www.cdc.gov . Available from: The Internet. Accessed 1997 March 19.
Cochrane Collaboration Home Page [Resource on the World Wide Web]. URL: http://hiru.mcmaster.ca/cochrane/ . Available from: The Internet. Accessed 1997 March 19.
Evidence-based Medicine Home Page [Resource on the World Wide Web]. URL: http://hiru.mcmaster.ca/ebm/ . Available from: The Internet. Accessed 1997 March 19.
FDA. Food and Drug Administration Home Page [Resource on the World Wide Web]. URL: http://www.fda.gov . Available from: The Internet. Accessed 1997 March 19.
NCI. National Cancer Institute Home Page [Resource on the World Wide Web]. URL: http://www.nci.nih.gov . Available from: The Internet. Accessed 1997 March 19.
NIH. National Institute of Health Home Page [Resource on the World Wide Web]. URL: http://www.nih.gov . Available from: The Internet. Accessed 1997 March 19.
NLM. NIH Home Page [Resource on the World Wide Web]. URL: http://www.nlm.nih.gov . Available from: The Internet. Accessed 1997 March 19.
WHO. World Health Organization Home Page [Resource on the World Wide Web]. URL: http://www.who.ch . Available from: The Internet. Accessed 1997 March 19.

Basic research study designs, including meta-analysis for the purpose of conducting a quantitative review of the literature, are also reviewed (10, 22). One of the central features of the course is a demonstration of the Cochrane Database of Systematic Reviews (CDSR), a new electronic journal distributed by BMJ Publishing (2). CDSR is produced by the international Cochrane Collaboration, whose purpose is to prepare, maintain, and disseminate systematic reviews of the effects of health care (1). Students are required to conduct a literature review (e.g., MEDLINE) on a topic of their choice and prepare and present an oral and written summary of this review in the format of a preliminary, "draft" meta-analysis. Some of the topics chosen by students can be seen in Table 2. Seminars were jointly led by a behavioral scientist, an information specialist, and a physician. Students also attended daily rounds on our clinical research unit in order to gain an understanding of how such a unit provides clinical care, conducts research protocols, and adheres to ethical standards (e.g., FDA/human subjects guidelines).

Evaluation

A minimum of two and maximum of 12 students have participated at any one time. The initial groups of students taking the elective provided formative evaluation feedback (20), which indicated that readings (research articles and "how to critique"

papers), checklists for critiquing articles, and the literature critiquing seminars themselves were thought to be the most valuable components of the course (all rated ≥ 9.5 on a 10-point scale). The "special project", patient rounds, and the operating committee meetings to approve new clinical protocols were also rated favorably (all ≥ 8), while previously designed, traditional special topics seminars designed for residents (on such topics as biostatistics, drug approval, etc.) were less well received (mean rating of 7.0). About two-thirds of the students thought the course should be required, while all thought that being team taught was better than being taught by only physicians. Revisions based on these early evaluation results included expansion of the seminars from two, 1-1/2 hour sessions/week to four, 2 hour sessions/week, and replacing the special topic seminars with additional critical appraisal sessions. A total of 52 students have participated to date. The following evaluation of the revised course was done during the 1994-95 and 1995-96 academic year as part of the overall evaluation conducted by the Medical School for all the senior year Science in the Clinics electives. One hundred ninety-two senior year students completed the evaluation questionnaire, 18 of which participated in the Critical Appraisal elective. Comparisons were made between these 18 students and the 174 students who participated in other electives. All responded to the same set of nine questions for the single Science

in the Clinics elective in which they participated. Independent (unpaired) t-tests between the two groups on the mean ratings for each item were calculated, accompanied by estimates of the standardized mean difference effect sizes (d) for each

item. d is the difference between the means for the critical appraisal elective and all other electives for each item divided by the pooled standard deviation

for that item, and results in a standardized effect size estimate in standard deviation units (SD_x). An effect size (d) of $0.20 SD_x$ is considered a small effect, $d=0.50$ a medium effect, and $d=0.80$ a large effect (3, 22). The National Institute of Education has characterized effect sizes as small as 1/3 to 1/2 standard deviation units as "educationally significant" (22).

Table 2. Example titles of "draft" meta-analyses prepared by senior medical students.

A Review of the Efficacy of Methotrexate Therapy for Ectopic Pregnancy

Chicken Pox Vaccine and Leukemia in children

Comparative Evaluation of the Mono Spot and Paul-Bennell tests in the Diagnosis of Infectious Mononucleosis

Effectiveness of Timolol/Pilocarpine Combination in Reducing Intraocular Pressure

Efficacy of Screening Mammography in Reducing Breast Cancer Mortality

Emergency Room Resuscitative Thoracotomy

Gender Specific Differences in Age of Onset of Schizophrenia

Meta-analysis of the Sensitivity of Rapid Strep Tests

Nifedipine Administration shows No Difference in Mortality in Patients Post Myocardial Infarction When Compared to Placebo: A Meta-analysis

Safety and Efficacy of Transjugular Intrahepatic Portosystemic Shunt

The Effects of Aerobic Exercise on Hypertension

Use of Recombinant Tissue Plasminogen Activator in Acute Thromboembolic Stroke: An Overview Analysis

Value of Antibiotics upon the Outcome of Chronic Obstructive Pulmonary Disease Exacerbations

RESULTS

In general, all electives were rated favorably by students, although this course was singled out as one of the most favorably evaluated of all senior electives. It was rated on average more favorably than the overall mean ratings for all electives on 8 of 9 scales, including "Quality of course overall" (4.39 vs. 3.92 on 5-point scale). Results for each item are summarized in Table 3. The effects favoring the Critical Appraisal elective in comparison to all electives were large for "Opportunities to acquire skills of scholarly reporting" and medium for "Clarity of course goals & objectives", providing "Experiences in applying scientific methods in solving medical problems", "Quality of presentation of basic science information in a clinical context", ,

"How well this course applied basic science principles to a clinical context", "Science in Clinics should remain a requirement in the fourth year", and "Quality of course overall". Since students in this elective were more in favor of retaining the entire program as a requirement, they were concomitantly less supportive of making the program as a whole elective, although this effect was small ($d = -0.23$).

DISCUSSION

This elective has been singled out by senior medical students as one of several that have received the highest course ratings for all Science in the Clinics electives. Differences favoring this elective compared to all electives generally ranged from medium to large on the various evaluation items.

However, all electives on average were generally rated favoring by students, thereby creating a "ceiling effect" making large differences difficult to obtain. Successive implementations of this and all electives are being evaluated and will be combined with the results of this evaluation to obtain a more stable estimate of their perceived usefulness by students.

The elective itself is being expanded in order to make it available to more senior medical students, and is fully subscribed for the 1996-97 academic year. Because it is conducted in a small group, seminar format that allows for student-faculty discussion and interaction, trade-offs between enlarging groups sizes and increasing the number of groups (and faculty) are

Table 3: Results of 1994-95 and 1995-96 senior medical students' course evaluations for elective on "Quantitative Appraisal of Published Information to Solve Clinical Problems" (critical appraisal) and all other Science in Clinics senior electives

Evaluation Item	Critical Appraisal Elective			All Other Electives			Pooled SD	t (p)	d
	n	Mean	SD	n	Mean	SD			
1. Clarity of course goals & objectives	18	4.22	0.73	174	3.59	1.09	1.08	2.07 (p=.017)	0.59
2. Opportunities to acquire skills of scholarly reporting	17	4.35	0.79	174	3.48	1.09	1.13	3.109 (p=.002)	0.81
3. Experiences in applying scientific methods in solving medical problems	18	4.00	1.14	168	3.39	1.22	1.23	2.03 (p=.043)	0.50
4. Quality of presentation of basic science information in a clinical context	18	4.22	0.88	172	3.70	1.13	1.12	1.89 (p=.060)	0.47
5. How well course applied basic science principles to a clinical context	18	4.28	0.83	171	3.73	1.16	1.14	1.97 (p=.050)	0.49
6. Quality of course overall	18	4.39	0.61	173	3.92	1.06	1.03	1.85 (p=.066)	0.46
7. Science in Clinics should remain a requirement in the fourth year	18	4.06	0.80	174	3.43	1.20	1.18	2.18 (p=.031)	0.54
8. Science in Clinics should be offered as an elective in the fourth year	18	3.28	1.33	174	3.54	1.12	1.12	-0.95 (p=.346)	-0.23
9. This Science in Clinics course should be continued	18	4.39	0.61	174	4.12	1.05	1.02-	1.09 (p=.277)	0.27

Items 1 - 6 rated on 1 (poor) to 5 (excellent) scale. Items 7 - 9 rated on 1 (strongly disagree) to 5 (strongly agree) scale. d is the standardized effect size estimate in standard deviation units (SD_x) for the differences between the means for the critical appraisal elective and all other electives, using the pooled standard deviation. An effect size (d) of 0.20 SD_x is considered a small effect, d=0.50 a medium effect, and d=0.80 a large effect (3, 21).

being weighed. Additional evaluation studies are needed for this and similar educational experiences to describe and estimate the "added value" of learning these skills on performance during residency and on patient care.

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